Thermoplastic Feedstock for 3D Printed Parts with Metal-Like Strength, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The ability to manufacture new functional parts and critical components in the extraterrestrial environment has tremendous value for NASA. Fused deposition modeling (FDM) is a method of additive manufacturing (3D printing) compatible with the microgravity environment, and has been demonstrated on the ISS. To reach the full potential of in-space manufacturing, objects printed with FDM must have strength approaching that of metals used in critical space systems. Development of higher strength feedstocks for FDM and post process strengthening treatments have the potential to bridge the gap between printed thermoplastics and metals.

IOS will develop a novel 3D printable feedstock material and post printing process that will enable NASA to 3D print plastic parts with metal-like mechanical properties in space. The target program for this material is the NASA In-Space Manufacturing Program. This material and process will be compatible with the printing technology in the additive manufacturing facility (AMF) on the ISS, and will be compatible with FDM printing tools selected for the multi-material fabrication laboratory, FabLab, currently being developed through NASA's NextSTEP program.

Anticipated Benefits

The target program for this material is the NASA In-Space Manufacturing Program, but will be applicable to all future missions where in-space manufacturing is required. IOS's novel high strength thermoplastic feedstock and post print strengthening process will be compatible with the printing technology in the additive manufacturing facility on the ISS, and with the FDM printing tools selected for the multi-material fabrication laboratory, FabLab, being developed through NASA's NextSTEP program.

The proposed product will be sold as a thermoplastic material for fused deposition modeling (FDM) additive manufacturing (AM) with metal-like strength, greater than the strongest material now available, which will expand the FDM market space from rapid prototyping into production of functional parts. AM is used across all commercial sectors, and plastic is by far the most used material. Higher strength plastics will push this market space further towards the higher revenue production segment.

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Small Business Innovation Research/Small Business Tech Transfer

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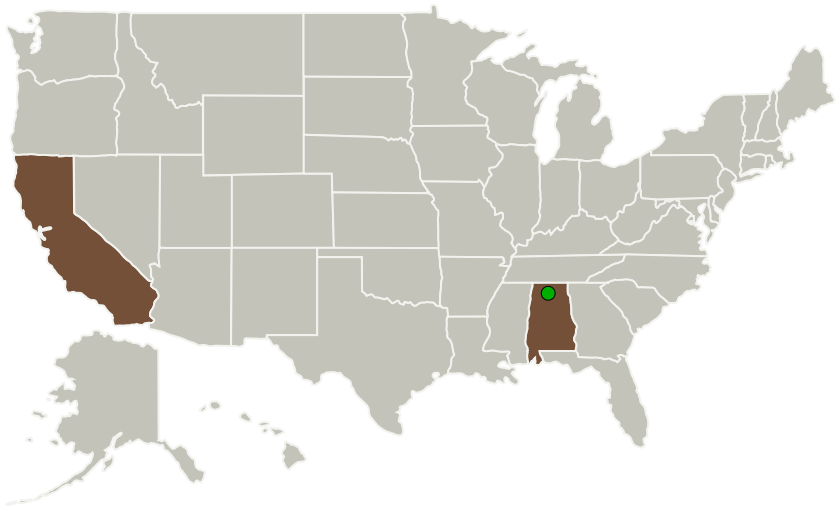
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Intelligent Optical Systems, Inc.	Lead Organization	Industry	Torrance, California
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140815)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Intelligent Optical Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

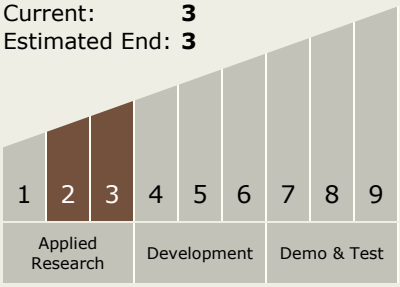
Carlos Torrez

Principal Investigator:

Paul Dicarmine

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Images

Final Summary Chart Image
Thermoplastic Feedstock for 3D Printed Parts with Metal-Like Strength, Phase I
(https://techport.nasa.gov/image/135045)

Project Image
Thermoplastic Feedstock for 3D Printed Parts with Metal-Like Strength, Phase I
(https://techport.nasa.gov/image/136511)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

Earth, The Moon, Mars